

# Администрирование сетевых подсистем

Лабораторная работа №11

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## Цель работы

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## Основная цель

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Приобретение практических навыков по настройке безопасного удалённого доступа к серверу по протоколу SSH.

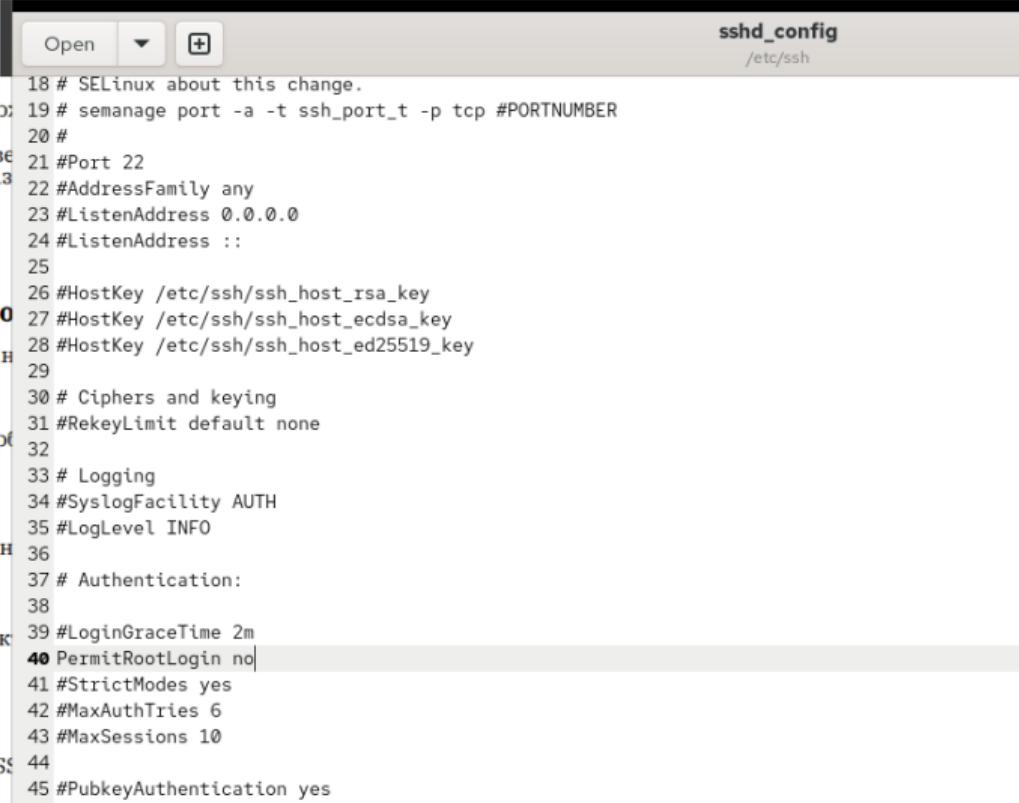
## Ход выполнения

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## Попытка входа под root

```
[dgavdadaev@client.dgavdadaev.net ~]$ ssh root@server.dgavdadaev.net
The authenticity of host 'server.dgavdadaev.net (192.168.1.1)' can't be established.
ED25519 key fingerprint is SHA256:n0w0vphoobfpKiXoFhmCpcTAKAVt01RYFK5Kxnw0XTU.
This host key is known by the following other names/addresses:
    ~/.ssh/known_hosts:1: [server.dgavdadaev.net]:2022
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'server.dgavdadaev.net' (ED25519) to the list of known hosts.
root@server.dgavdadaev.net's password:
Permission denied, please try again.
root@server.dgavdadaev.net's password:
Permission denied, please try again.
root@server.dgavdadaev.net's password:
root@server.dgavdadaev.net: Permission denied (publickey, gssapi-keyex, gssapi-with-mic, password).
[dgavdadaev@client.dgavdadaev.net ~]$
```

## Настройка запрета root-доступа



The screenshot shows a terminal window with the title "sshd\_config" and the path "/etc/ssh". The file content is a configuration for the SSH daemon. Line 40, which contains the directive "PermitRootLogin no", is highlighted with a gray background.

```
18 # SELinux about this change.  
19 # semanage port -a -t ssh_port_t -p tcp #PORTNUMBER  
20 #  
21 #Port 22  
22 #AddressFamily any  
23 #ListenAddress 0.0.0.0  
24 #ListenAddress ::  
25  
26 #HostKey /etc/ssh/ssh_host_rsa_key  
27 #HostKey /etc/ssh/ssh_host_ecdsa_key  
28 #HostKey /etc/ssh/ssh_host_ed25519_key  
29  
30 # Ciphers and keying  
31 #RekeyLimit default none  
32  
33 # Logging  
34 #SyslogFacility AUTH  
35 #LogLevel INFO  
36  
37 # Authentication:  
38  
39 #LoginGraceTime 2m  
40 PermitRootLogin no  
41 #StrictModes yes  
42 #MaxAuthTries 6  
43 #MaxSessions 10  
44  
45 #PubkeyAuthentication yes
```

Рис. 2: sshd config — запрет root

## Проверка после запрета

```
[dgavdadaev@client.dgavdadaev.net ~]$  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh root@server.dgavdadaev.net  
root@server.dgavdadaev.net's password:  
Permission denied, please try again.  
root@server.dgavdadaev.net's password:  
Permission denied, please try again.  
root@server.dgavdadaev.net's password:  
root@server.dgavdadaev.net: Permission denied (publickey, gssapi-keyex, gssapi-wit-  
h-mic, password).  
[dgavdadaev@client.dgavdadaev.net ~]$
```

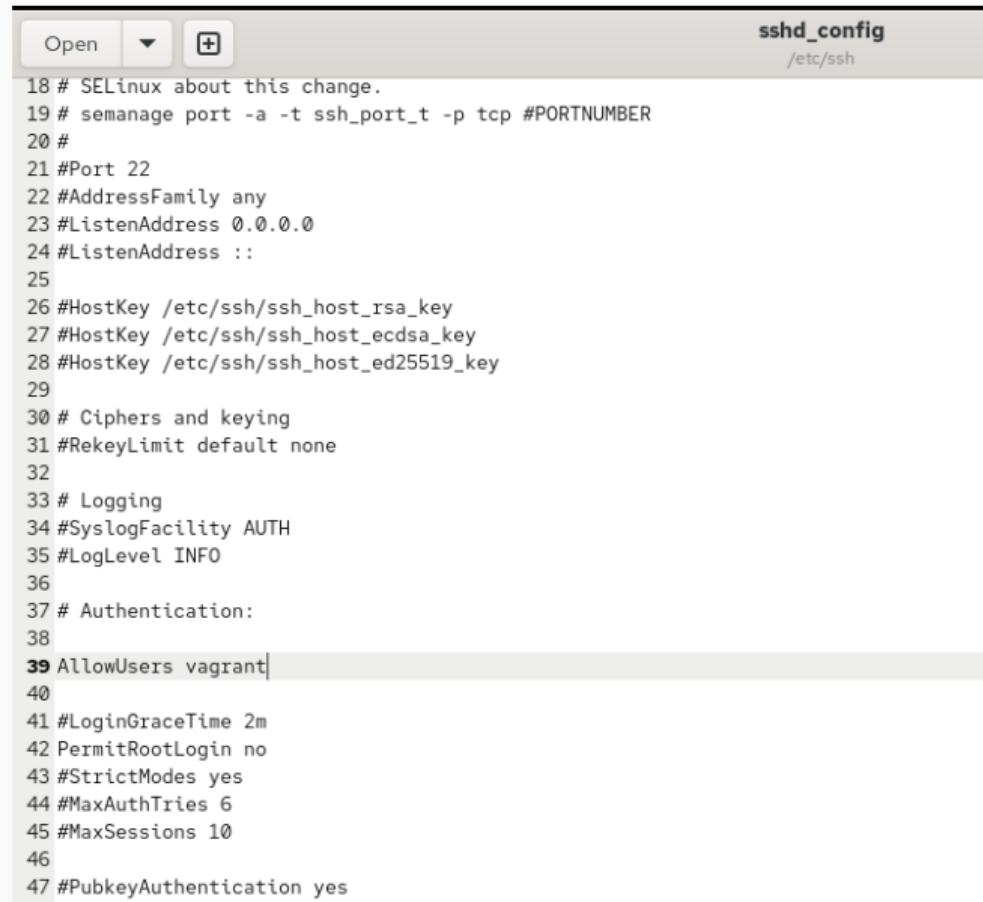
Рис. 3: Отказ после запрета root

## Успешный вход обычного пользователя

```
[dgavdadaev@client.dgavdadaev.net ~]$  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net  
dgavdadaev@server.dgavdadaev.net's password:  
Web console: https://server.dgavdadaev.net:9090/ or https://10.0.2.15:9090/  
  
Last login: Thu Dec  4 09:09:01 2025  
[dgavdadaev@server.dgavdadaev.net ~]$  
logout  
Connection to server.dgavdadaev.net closed.  
[dgavdadaev@client.dgavdadaev.net ~]$ █
```

Рис. 4: Успешный вход пользователя

## Настройка AllowUsers



The screenshot shows a terminal window with the title "sshd\_config" and the path "/etc/ssh". The file content is a configuration for the SSH daemon. Line 39, which contains the directive "AllowUsers vagrant", is highlighted with a gray background. The rest of the file includes various SSH configuration options like port numbers, host keys, ciphers, logging, and authentication settings.

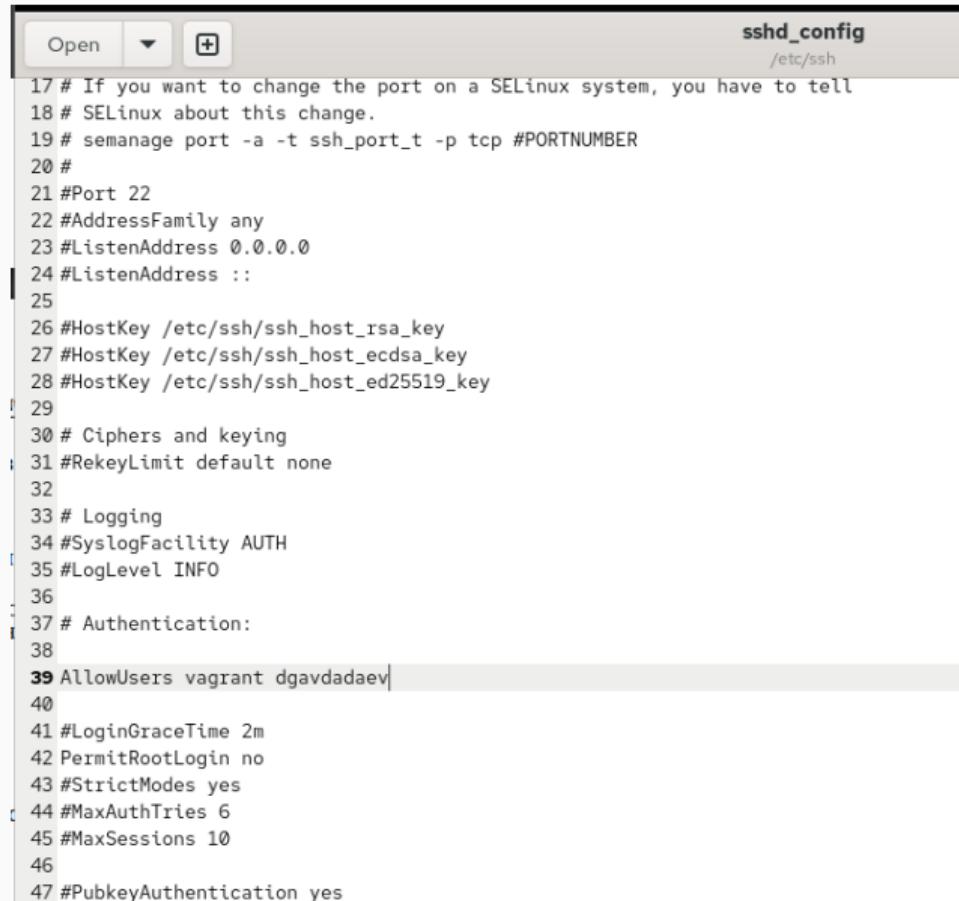
```
18 # SELinux about this change.
19 # semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
20 #
21 #Port 22
22 #AddressFamily any
23 #ListenAddress 0.0.0.0
24 #ListenAddress :::
25
26 #HostKey /etc/ssh/ssh_host_rsa_key
27 #HostKey /etc/ssh/ssh_host_ecdsa_key
28 #HostKey /etc/ssh/ssh_host_ed25519_key
29
30 # Ciphers and keying
31 #RekeyLimit default none
32
33 # Logging
34 #SyslogFacility AUTH
35 #LogLevel INFO
36
37 # Authentication:
38
39 AllowUsers vagrant
40
41 #LoginGraceTime 2m
42 PermitRootLogin no
43 #StrictModes yes
44 #MaxAuthTries 6
45 #MaxSessions 10
46
47 #PubkeyAuthentication yes
```

## Блокировка пользователя dgavdadaev

```
[dgavdadaev@client.dgavdadaev.net ~]$  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net  
dgavdadaev@server.dgavdadaev.net's password:  
Permission denied, please try again.  
dgavdadaev@server.dgavdadaev.net's password:  
Permission denied, please try again.  
dgavdadaev@server.dgavdadaev.net's password:  
dgavdadaev@server.dgavdadaev.net: Permission denied (publickey,gssapi-keyex,gssapi-with-mic,password).  
[dgavdadaev@client.dgavdadaev.net ~]$
```

Рис. 6: Отказ пользователя dgavdadaev

# Расширение AllowUsers



```
sshd_config
/etc/ssh

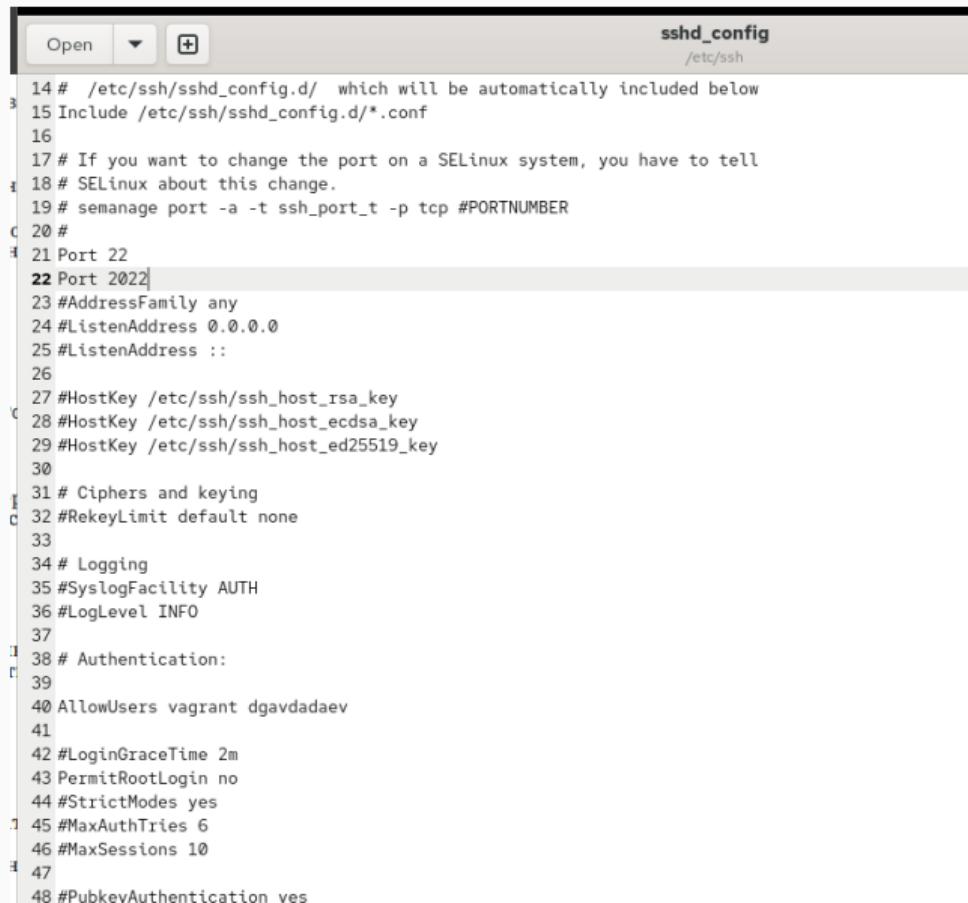
17 # If you want to change the port on a SELinux system, you have to tell
18 # SELinux about this change.
19 # semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
20 #
21 #Port 22
22 #AddressFamily any
23 #ListenAddress 0.0.0.0
24 #ListenAddress :::
25
26 #HostKey /etc/ssh/ssh_host_rsa_key
27 #HostKey /etc/ssh/ssh_host_ecdsa_key
28 #HostKey /etc/ssh/ssh_host_ed25519_key
29
30 # Ciphers and keying
31 #RekeyLimit default none
32
33 # Logging
34 #SyslogFacility AUTH
35 #LogLevel INFO
36
37 # Authentication:
38
39 AllowUsers vagrant dgavdadaev|
40
41 #LoginGraceTime 2m
42 PermitRootLogin no
43 #StrictModes yes
44 #MaxAuthTries 6
45 #MaxSessions 10
46
47 #PubkeyAuthentication yes
```

## Расширение AllowUsers

```
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net  
dgavdadaev@server.dgavdadaev.net's password:  
Web console: https://server.dgavdadaev.net:9090/ or https://10.0.2.15:9090/  
  
Last failed login: Thu Dec  4 09:17:30 UTC 2025 from 192.168.1.30 on ssh:notty  
There were 3 failed login attempts since the last successful login.  
Last login: Thu Dec  4 09:16:22 2025 from 192.168.1.30  
[dgavdadaev@server.dgavdadaev.net ~]$  
logout  
Connection to server.dgavdadaev.net closed.  
[dgavdadaev@client.dgavdadaev.net ~]$
```

Рис. 8: Успешный вход

## Добавление второго порта



```
Open + sshd_config /etc/ssh  
14 # /etc/ssh/sshd_config.d/ which will be automatically included below  
15 Include /etc/ssh/sshd_config.d/*.conf  
16  
17 # If you want to change the port on a SELinux system, you have to tell  
18 # SELinux about this change.  
19 # semanage port -a -t ssh_port_t -p tcp #PORTNUMBER  
20 #  
21 Port 22  
22 Port 2022  
23 #AddressFamily any  
24 #ListenAddress 0.0.0.0  
25 #ListenAddress ::  
26  
27 #HostKey /etc/ssh/ssh_host_rsa_key  
28 #HostKey /etc/ssh/ssh_host_ecdsa_key  
29 #HostKey /etc/ssh/ssh_host_ed25519_key  
30  
31 # Ciphers and keying  
32 #RekeyLimit default none  
33  
34 # Logging  
35 #SyslogFacility AUTH  
36 #LogLevel INFO  
37  
38 # Authentication:  
39  
40 AllowUsers vagrant dgavdadaev  
41  
42 #LoginGraceTime 2m  
43 PermitRootLogin no  
44 #StrictModes yes  
45 #MaxAuthTries 6  
46 #MaxSessions 10  
47  
48 #PubkeyAuthentication yes
```

# Ошибка SELinux

```
[root@server.dgavdadaev.net ~]# systemctl restart sshd
[root@server.dgavdadaev.net ~]# systemctl status sshd
● sshd.service - OpenSSH server daemon
   Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; preset: enabled)
   Active: active (running) since Thu 2025-12-04 09:20:26 UTC; 6s ago
     Invocation-ID: c2de27b36b71414899d3f811393c1cd9
      Docs: man:sshd(8)
             man:sshd_config(5)
    Main PID: 15687 (sshd)
       Tasks: 1 (limit: 10278)
      Memory: 1.3M (peak: 1.5M)
        CPU: 4ms
       CGroup: /system.slice/sshd.service
               └─15687 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups

Dec 04 09:20:26 server.dgavdadaev.net systemd[1]: Starting sshd.service - OpenSSH server daemon...
Dec 04 09:20:26 server.dgavdadaev.net sshd[15687]: error: Bind to port 2022 on 0.0.0.0 failed: Permission denied.
Dec 04 09:20:26 server.dgavdadaev.net sshd[15687]: error: Bind to port 2022 on :: failed: Permission denied.
Dec 04 09:20:26 server.dgavdadaev.net systemd[1]: Started sshd.service - OpenSSH server daemon.
Dec 04 09:20:26 server.dgavdadaev.net sshd[15687]: Server listening on 0.0.0.0 port 22.
Dec 04 09:20:26 server.dgavdadaev.net sshd[15687]: Server listening on :: port 22.
[root@server.dgavdadaev.net ~]#
```

## Разрешение порта в SELinux

## и firewall

```
[root@server.dgavdadaev.net ~]# semanage port -a -t ssh_port_t -p tcp 2022
[root@server.dgavdadaev.net ~]# firewall-cmd --add-port=2022/tcp
success
[root@server.dgavdadaev.net ~]# firewall-cmd --add-port=2022/tcp --permanent
success
[root@server.dgavdadaev.net ~]# systemctl restart sshd
[root@server.dgavdadaev.net ~]# systemctl status sshd
● sshd.service - OpenSSH server daemon
   Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; preset: enabled)
   Active: active (running) since Thu 2025-12-04 09:22:20 UTC; 4s ago
     Invocation-ID: 516b008ababd411faa60dbdd5f625917
      Docs: man:sshd(8)
             man:sshd_config(5)
    Main PID: 15982 (sshd)
```

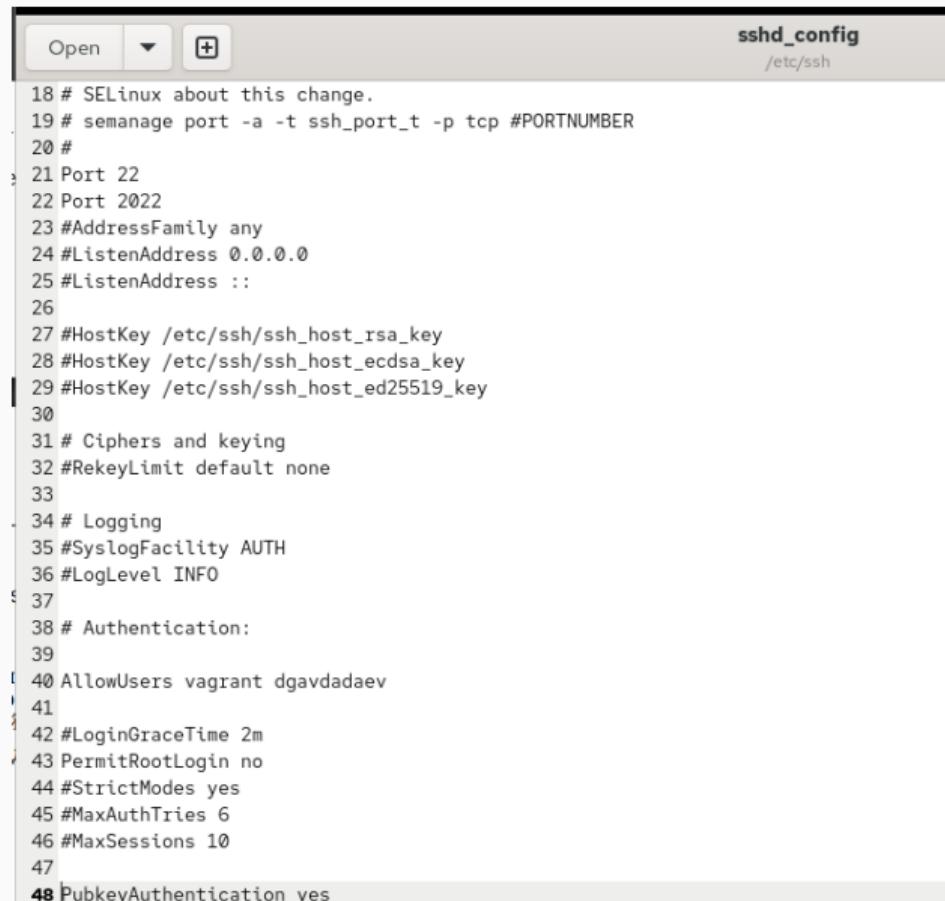
# Подключение по порту 2022

```
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net
dgavdadaev@server.dgavdadaev.net's password:
Web console: https://server.dgavdadaev.net:9090/ or https://10.0.2.15:9090/
Last login: Thu Dec  4 09:18:43 2025 from 192.168.1.30
[dgavdadaev@server.dgavdadaev.net ~]$ sudo -i
[sudo] password for dgavdadaev:
[root@server.dgavdadaev.net ~]#
logout
[dgavdadaev@server.dgavdadaev.net ~]$ 
logout
Connection to server.dgavdadaev.net closed.
[dgavdadaev@client.dgavdadaev.net ~]$ 
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net -p2022
dgavdadaev@server.dgavdadaev.net's password:
Web console: https://server.dgavdadaev.net:9090/ or https://10.0.2.15:9090/
Last login: Thu Dec  4 09:22:49 2025 from 192.168.1.30
[dgavdadaev@server.dgavdadaev.net ~]$ sudo -i
[sudo] password for dgavdadaev:
[root@server.dgavdadaev.net ~]#
logout
[dgavdadaev@server.dgavdadaev.net ~]$ 
logout
Connection to server.dgavdadaev.net closed.
[dgavdadaev@client.dgavdadaev.net ~]$ █
```

---

Рис. 11: Подключение по 2022

# Включение PubkeyAuthentication



The screenshot shows a terminal window with the title "sshd\_config" and the path "/etc/ssh". The file content is a configuration for the SSH daemon. Line 48, which contains the "PubkeyAuthentication yes" directive, is highlighted with a yellow background.

```
18 # SELinux about this change.
19 # semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
20 #
21 Port 22
22 Port 2022
23 #AddressFamily any
24 #ListenAddress 0.0.0.0
25 #ListenAddress :::
26
27 #HostKey /etc/ssh/ssh_host_rsa_key
28 #HostKey /etc/ssh/ssh_host_ecdsa_key
29 #HostKey /etc/ssh/ssh_host_ed25519_key
30
31 # Ciphers and keying
32 #RekeyLimit default none
33
34 # Logging
35 #SyslogFacility AUTH
36 #LogLevel INFO
37
38 # Authentication:
39
40 AllowUsers vagrant dgavdadaev
41
42 #LoginGraceTime 2m
43 PermitRootLogin no
44 #StrictModes yes
45 #MaxAuthTries 6
46 #MaxSessions 10
47
48 PubkeyAuthentication yes
```

## Вход без пароля

```
|      . o.*o.|  
| S =.B+. |  
| ..o++o** .|  
| .*.. = ...|  
| o o. . o|  
| E . . . o |  
+---[SHA256]---+  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh-copy-id dgavdadaev@server.dgavdadaev.net  
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: ssh-add -L  
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed  
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys  
dgavdadaev@server.dgavdadaev.net's password:  
  
Number of key(s) added: 1  
  
Now try logging into the machine, with: "ssh 'dgavdadaev@server.dgavdadaev.net'"  
and check to make sure that only the key(s) you wanted were added.  
  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net  
Web console: https://server.dgavdadaev.net:9090/ or https://10.0.2.15:9090/  
  
Last login: Thu Dec  4 09:23:06 2025 from 192.168.1.30  
[dgavdadaev@server.dgavdadaev.net ~]$  
logout  
Connection to server.dgavdadaev.net closed.  
[dgavdadaev@client.dgavdadaev.net ~]$ █
```

Рис. 13: Безпарольный вход

## Создание туннеля

```
[dgavdadaev@client.dgavdadaev.net ~]$  
[dgavdadaev@client.dgavdadaev.net ~]$ lsof | grep TCP  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh -fNL 8080:localhost:80 dgavdadaev@server.dgavdadaev.net  
[dgavdadaev@client.dgavdadaev.net ~]$ lsof | grep TCP  
ssh    15464          dgavdadaev  3u      IPv4          97552  0t0      T  
CP client.dgavdadaev.net:55592->mail.dgavdadaev.net:ssh (ESTABLISHED)  
ssh    15464          dgavdadaev  4u      IPv6          97562  0t0      T  
CP localhost:webcache (LISTEN)  
ssh    15464          dgavdadaev  5u      IPv4          97563  0t0      T  
CP localhost:webcache (LISTEN)  
[dgavdadaev@client.dgavdadaev.net ~]$
```

Рис. 14: TCP после туннеля

## Проверка в браузере

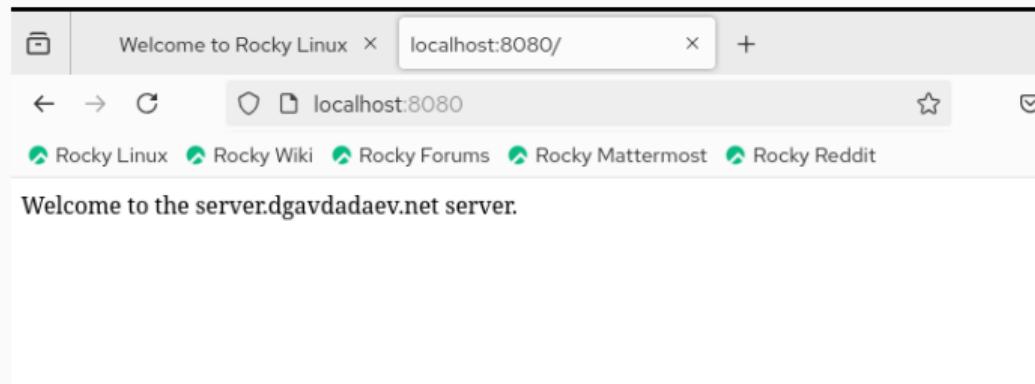


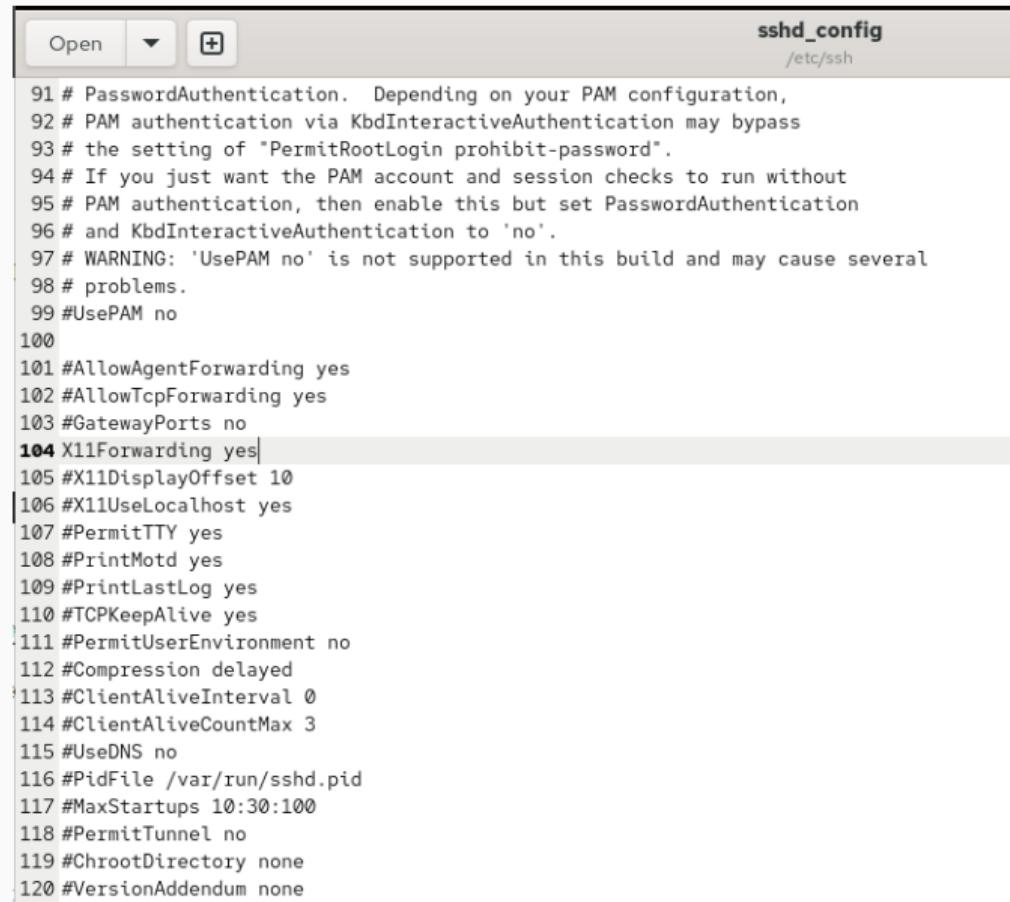
Рис. 15: localhost:8080

## Команды по SSH

```
[dgavdadaev@client.dgavdadaev.net ~]$  
[dgavdadaev@client.dgavdadaev.net ~]$ ssh dgavdadaev@server.dgavdadaev.net MAIL=~/Maildir mail  
s-nail version v14.9.24. Type `?' for help  
/home/dgavdadaev/Maildir: 3 messages 1 unread  
  1 dgavdadaev      2025-11-30 11:04  18/668  "test1"      "  
  2 dgavdadaev@client.dg 2025-11-30 11:18  21/859  "LMTTP test"  "  
►U 3 dgavdadaev      2025-11-30 11:38  22/840  "test3"      "  
q  
Held 3 messages in /home/dgavdadaev/Maildir  
[dgavdadaev@client.dgavdadaev.net ~]$ █
```

Рис. 16: Просмотр почты

# Включение X11Forwarding



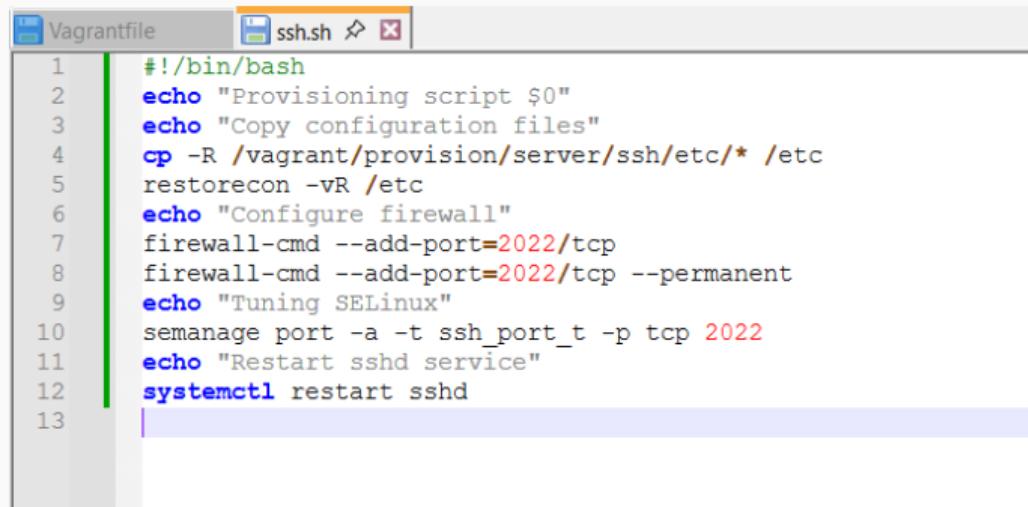
```
sshd_config  
/etc/ssh  
91 # PasswordAuthentication. Depending on your PAM configuration,  
92 # PAM authentication via KbdInteractiveAuthentication may bypass  
93 # the setting of "PermitRootLogin prohibit-password".  
94 # If you just want the PAM account and session checks to run without  
95 # PAM authentication, then enable this but set PasswordAuthentication  
96 # and KbdInteractiveAuthentication to 'no'.  
97 # WARNING: 'UsePAM no' is not supported in this build and may cause several  
98 # problems.  
99 #UsePAM no  
100  
101 #AllowAgentForwarding yes  
102 #AllowTcpForwarding yes  
103 #GatewayPorts no  
104 X11Forwarding yes  
105 #X11DisplayOffset 10  
106 #X11UseLocalhost yes  
107 #PermitTTY yes  
108 #PrintMotd yes  
109 #PrintLastLog yes  
110 #TCPKeepAlive yes  
111 #PermitUserEnvironment no  
112 #Compression delayed  
113 #ClientAliveInterval 0  
114 #ClientAliveCountMax 3  
115 #UseDNS no  
116 #PidFile /var/run/sshd.pid  
117 #MaxStartups 10:30:100  
118 #PermitTunnel no  
119 #ChrootDirectory none  
120 #VersionAddendum none
```

# Ошибка при запуске Firefox

```
[dgavdadaev@client.dgavdadaev.net ~]$ ssh -YC dgavdadaev@server.dgavdadaev.net firefox
Warning: No xauth data; using fake authentication data for X11 forwarding.
X11 forwarding request failed on channel 0
Error: no DISPLAY environment variable specified
[dgavdadaev@client.dgavdadaev.net ~]$ ssh -YC dgavdadaev@server.dgavdadaev.net firefox
Warning: No xauth data; using fake authentication data for X11 forwarding.
X11 forwarding request failed on channel 0
Error: no DISPLAY environment variable specified
[dgavdadaev@client.dgavdadaev.net ~]$
```

Рис. 18: Ошибка Firefox

## Скрипт ssh.sh



The screenshot shows a terminal window with two tabs: "Vagrantfile" and "ssh.sh". The "ssh.sh" tab is active and displays a shell script with the following content:

```
1 #!/bin/bash
2 echo "Provisioning script $0"
3 echo "Copy configuration files"
4 cp -R /vagrant/provision/server/ssh/etc/* /etc
5 restorecon -vR /etc
6 echo "Configure firewall"
7 firewall-cmd --add-port=2022/tcp
8 firewall-cmd --add-port=2022/tcp --permanent
9 echo "Tuning SELinux"
10 semanage port -a -t ssh_port_t -p tcp 2022
11 echo "Restart sshd service"
12 systemctl restart sshd
13 |
```

Рис. 19: ssh.sh

## Вывод

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## Итоги работы

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- Запрещён вход root
- Ограничены доступные пользователи
- Настроены несколько портов SSH
- Разрешён нестандартный порт в SELinux/firewalld
- Настроена аутентификация по ключам
- Созданы SSH-туннели
- Изучены консольные и графические приложения SSH